FINAL REPORT
DEPARTMENT OF PESTICIDE REGULATION
PEST MANAGEMENT GRANT

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Project Title: BIORATIONAL CLING PEACH ORCHARD SYSTEMS (BCPOS)

Summary: During 1997 a demonstration and education program to manage Oriental fruit moth, *Grapholita molesta,* and peach twig borer, *Anarsia lineatella,* with mating disruption and *Bacillus thuringiensis* sprays was implemented through funding support by the California Department of Pesticide Regulation. Janine Hasey, Sutter and Yuba Counties farm advisor, was project leader and coordinator for the Sacramento Valley. Area IPM advisor Walt Bentley was the San Joaquin Valley coordinator. Cooperators included Area IPM advisor Carolyn Pickel and Butte County farm advisor Bill Olson in the Sacramento Valley, and San Joaquin Valley farm advisors Bob Beede (Kings County), Maxwell Norton (Merced County) and Roger Duncan (Stanislaus County). Field representatives from the California Canning Peach association also participated. The primary goal was to manage key pests using alternatives to dormant insecticides and the more disruptive growing season sprays being aimed at them. The use of disruptive, broad spectrum sprays has led to increased use of miticides throughout the Central Valley to control outbreaks of webspinning spider mites that follow the applications. Also, with the concerns involving dormant insecticide spray residues being found in streams and rivers, we were implementing a program that would mitigate the need for this important pest management spray. We hoped to 1) show successful use of mating disruption (pheromone confusion) for the key pests, and 2) develop information on secondary pests that were previously controlled by either dormant or in season sprays applied for primary pests.

In the six counties, there were 387 acres in the project where either the complete or partial mating disruption program was used which eliminated or reduced several in season sprays.

Additionally, Bt was used on 246 of these acres, eliminating the dormant insecticide. Pheromone traps were used to monitor adult males of OFM, PTB, San Jose scale (SJS) and in the San Joaquin Valley, omnivorous leaf roller (OLR). Orchards in Sutter, Yuba and Butte Counties were monitored in April for shoot strikes caused from overwintered PTB to check the effectiveness of Bt sprays. Orchards in all counties were monitored in May or June for shoot strikes caused by OFM or PTB to determine the effectiveness of mating disruption. In each orchard or cultivars monitored during the season, 500 (Sacramento Valley) or 1,000 fruits (San Joaquin Valley) were examined before sorting fruit during the harvest operation. Overall, worm damage from OFM and PTB was less than 1.6% in most blocks with a few exceptions. In Merced County, worm damage was 5% or higher due to the high moth pressure from almond orchards. Larger pheromone treated blocks and areas away from major sources of moths, such as found in the Kings County study area, can use this technique for control of the primary pests while areas such as Merced County will have more problems. Particularly, mature and nonsprayed almond orchards provide sources of PTB, which mate and then fly into stonefruit orchards resulting in infested fruit. An unexpected secondary pest in Sutter and Yuba Counties, oblique banded leafroller, caused fruit damage in both mating disruption and standard spray blocks. This problem is being researched on a grant extension in 1998.

A total of 22 growers and several pest control advisors cooperated in the program. They and others were reached throughout the season through several meetings held in the counties during key times in the control and monitoring of OFM and PTB when using Bt sprays and mating disruption. Growers are interested in moving away from the dormant and disruptive growing season spray program for both PTB and OFM. Bt bloom sprays and mating disruption seem viable alternatives. The cost of two Bt bloom sprays wi no more than the cost of a dormant insecticide spray. Higher costs are the largest obstacle to growers adopting mating disruption however. The complete mating disruption program costs about $110.00/ acre more than a standard spray program. By using a partial program that includes mating disruption plus 1-2 sprays, costs are reduced over the complete program by $50.00-$70.00/acre. However, growers and pest control advisors must approach this pest management technique with caution. It is imperative that those involved in such a program be willing to spend extra time looking for shoot strikes along with monitoring for secondary pests such as katydid, plant bugs and oblique banded leafroller.

Results and Discussion:

Objective one: *Implement a biorational program through field demonstrations for cling peaches to reduce insecticides in the Sacramento and San Joaquin Valleys. This program will be aimed at eliminating the dormant organophosphate, carbamate or pyrethroid spray for peach twig borer (PTB), and reducing or eliminating in season insecticides aimed at oriental fruit moth (OFM) and PTB.*

Sutter and Yuba Counties: Bloom time sprays of *Bacillus thuringiensis* (Bt) were used instead of a dormant insecticide spray on 153.4 acres to control overwintered PTB. An additional 25 acres

that had a dormant insecticide were sprayed with Bt also. Mating disruption (MD) was used on 186.4 acres. Of this, 127 acres were in the complete OFM and PTB program (four applications of pheromone dispensers), eliminating the need for in season insecticides and miticides. The remaining 59.4 acres were on the partial program - one application each of OFM and PTB dispensers in the spring followed by a summer spray. This program eliminates 1-2 in season insecticides.

Butte County: Bt was used on 56 acres eliminating a dormant insecticide spray; an additional 28 acres had a dormant insecticide and Bt sprays. The complete MD program was used on 3 acres while the partial MD program was used on 94 acres.

Stanislaus County: There were 26 acres on the partial MD program but with no summer spray; almost 17 acres of these peaches had Bt bloom sprays and no dormant insecticide spray. A 38-acre block had one spring OFM MD application and a dormant insecticide; Bt sprays were applied on 15 of these acres. At another site, 9.5 acres were treated with Bt sprays and had no insecticides nor mating disruption.

Merced County: Sixteen acres were in the complete mating disruption program; of these acres, 10.5 had Bt sprays and no dormant insecticide spray. However, the 11-acre block had to be sprayed with an insecticide in late spring because of high PTB counts. The 5-acre block was sprayed in late spring because of plant bug damage, a secondary pest. Another 11 acres had two OFM and one PTB MD applications. No dormant spray nor Bloom time Bt sprays were used. An insecticide was used in spring though for omnivorous leafroller (OLR) control.

Kings County: There were 12.5 acres in the complete mating disruption program. Of these, 3.3 acres had no dormant insecticide spray. No Bt sprays were used.

In the six counties, there were 387 acres in the project where either the complete or partial mating disruption program was used which eliminated or reduced several in season sprays. Additionally, Bt was used on 246 of these acres, eliminating the dormant insecticide. Additionally, another 68 acres were sprayed with both a dormant insecticide and Bt sprays. There would have been more acreage in the program but due to flooding in January in Yuba County, three cooperators lined up in December were unable to participate.

One difficulty we had was getting the growers to use Bt at bloom in place of the dormant insecticide. Some reasons included 1) not enough lead time to get cooperators who had not sprayed since many growers apply the dormant spray in December and, 2) peach growers had not used this spray before and many knew nothing about it or they were skeptical. The Bt program and our results will be emphasized at late fall meetings before this upcoming dormant season. The positive is that there were no or very low shoot strikes in April suggesting the overwintered PTB was controlled with Bt sprays in Sutter, Yuba and Butte Counties, and several growers now have experience using Bt. These growers are much more likely to adopt this practice in the future. Many cooperators had used mating disruption before although some

increased their acreage using this pest management technique. Other growers totally new to MD plan to use it again next year because of positive results, at least the partial program because it costs less. A main obstacle to growers adopting the complete mating disruption program is the cost that is about $110.00 per acre more than a standard spray program. This cost does not include an additional $10.00-$20.00/acre needed for monitoring. Another obstacle is a grower mindset that if pheromone dispensers are used, no spraying is necessary, even for secondary pests.

The percent worm (OFM and PTB) at harvest in all but three MD blocks in Sutter, Yuba and Butte Counties was less than 1.6%, usually less than 0.8%. For each grower, these mating disruption blocks were usually contiguous and 10 acres or larger. There was very low worm damage in Kings County, both MD blocks were less than 0.8%. There are no other crop sources of OFM or PTB surrounding these blocks. The MD blocks in Merced County had 4.8% or higher PTB damage. Two of these blocks are surrounded by untreated almonds that serve as a source for PTB. Another block has houses on two sides where isolated backyard trees could serve as sources for moths. Mating disruption works best in large blocks and where neighboring orchards also use it to control OFM and PTB. Stanislaus County harvest data has not been tabulated yet.

Objective two: *Form project management teams in the Sacramento and San Joaquin Valleys. The principal investigator and cooperators will locate grower and PCA cooperators.*

Grower cooperators in Sutter and Yuba Counties included Kris Dhanota, Taisha Thiara, Harsev and J.R. Thiara, Ignacio Ayala, Mohinder Ghag, Gurgit Hundal and Jeff and Dan Stephens. Butte County cooperators were Gary Carlin, Mohinder Ghag, Brad and Chalmer Johnson, Lee Austin and Greg Correa of Onstott Orchards. PCA cooperators in the Sacramento Valley included Greg Anderson, Kulwant Johl, Art Ramos, Rick Gerst and Robert Hornyak.

Blaine Yagi, Eugene Kajioka, Sherman Kishi and Robert Chad were the grower cooperators in Merced County. In Stanislaus County, Tim Jarrett and Tom Parks were cooperators and Paul Muradian and Lance Jackson were the cooperators in Kings County. PCA cooperators included Cindy Lashbrook, Les Nygren, James White, Eric Neese, and Frank Morales.

Heidi Sanders and Ajayab Dhaddey of the California Canning Peach Association were also part of the team, helped find cooperators and attended meetings.

Objective three: *Implement monitoring programs for both primary and secondary pests and management for associated pests no longer controlled by broad spectrum sprays previously directed at primary pests.*

Pheromone traps were used to monitor adult males of OFM, PTB, San Jose scale (SJS) and in the San Joaquin Valley, omnivorous leaf roller (OLR). The use of the SJS pheromone to monitor male scale flight also allowed for monitoring two key parasitoids, *Encarsi perniciosi*

and *Aphytis spp.*Additionally, in the Sacramento Valley, peach blocks next to walnut orchards were monitored with pheromone traps for codling moth, an occasional pest of peach, and peaches next to riparian areas were monitored for stinkbugs using three types of traps. In Sutter and Yuba Counties, several standard sprayed orchards were monitored for comparison. Either one or two pheromone traps for each pest were hung in each orchard or cultivar within the orchard. Cultivars monitored ranged from extra early to extra late. Pheromone trap placement and weekly monitoring was under the direction of the cling peach farm advisors.

Orchards in Sutter, Yuba and Butte Counties were monitored in April for shoot strikes caused from overwintered PTB to check the effectiveness of Bt sprays. Orchards in all counties were monitored in May or June for shoot strikes caused by OFM or PTB to determine the effectiveness of mating disruption. In each orchard or cultivars monitored during the season, 500 (Sacramento Valley) or 1,000 fruits (San Joaquin Valley) were examined before sorting fruit during the harvest operation. A few harvests were missed because of how early and rapidly the harvest progressed and because of unexpected harvests due to rain in the north. Grade sheets and personal communication with the growers were used to assess worm damage in these cases.

Some results are listed under Objective one. Tables of all above data are included in the attachments. A secondary pest problem emerged during harvest mainly in Sutter and Yuba counties. Damage from what we believe to be second generation oblique banded leafroller (OBLR) was mainly in the early and late varieties and as high as 9.6% in one block. Leafroller damage is usually thought to occur in MD blocks where no sprays are used but we found high leafroller damage in our standard spray blocks and blocks on the partial MD program also. A photo is attached showing OBLR fruit damage. We found essentially no damage from first generation OBLR that was controlled by the Bt bloom sprays. Further research is needed to determine when this leafroller is causing damage and how to control it. In the San Joaquin Valley, two orchards were sprayed to prevent secondary pest problems by omnivorous leafroller and plant bug.

Objective four: *Involve pest control advisors and growers in "hands on" learning experiences through breakfast and field meetings during key periods throughout the season.*

Joint meetings were held for grower cooperators and PCAs in Sutter, Yuba and Butte Counties where Carolyn Pickel, Janine Hasey and Bill Olson led the discussions. During a Breakfast meeting on February 19, we discussed applying Bt sprays and OFM pheromone dispensers along with representatives from Abbott Labs and the three pheromone companies. Applying PTB pheromone dispensers was the topic of the March 27 breakfast meeting, and the second OFM and PTB applications and shoot strike monitoring were discussed at the May 20 breakfast meeting. A field meeting was held on June 26 to demonstrate OFM and PTB shoot strike monitoring. Through these meetings we reached 22 PCAs, five who were new to the business and 36 growers and cooperators. Before these focused meetings, a Tri-County Peach Meeting was held on January 23 where results and economics of the 1996 complete mating disruption program were covered.

In each county in the San Joaquin Valley, training programs were held on the use of alternatives to the dormant spray for managing PTB. These meetings presented results on research-based projects in years preceding the implementation project.

For Merced and Stanislaus growers farm advisors Maxwell Norton and Roger Duncan held a Cling Peach Pest Management Program on January 22 in Turlock. Information was also distributed to Apricot growers on March 11 in Patterson at the Stanislaus County Apricot Growers Meeting. Although this commodity was not included in the proposal, mating disruption for these two pests is a workable program because of the relative isolation of orchards and early harvest when compared to many cling peach cultivars. Maxwell presented information and updates on this project at Breakfast meetings beginning on March 12 and continued 3/26, 4/9, 4/23, 5/7, 5/21, 6/4, 6/18, 7/2, and 7/16. Roger also had many breakfast meetings beginning on March 11, and continuing on 3/25, 4/8, 4/22, 5/6, 5/20, 6/3, 6/17, and 7/1.

In Kings County a different approach was taken by farm advisor Bob Beede. Bob scheduled a series of three meetings with each devoted to an in depth coverage of the three primary pests of deciduous fruits. On February 6 the meeting was devoted to the biology, sampling and management of San Jose Scale. On February 13 the meeting covered the same area for Oriental fruit moth and on February 21 the meeting was devoted to peach twig borer. Information on the dynamics of the pests and beneficials was covered plus the research-based information from past studies emphasizing mating disruption in peaches.

When harvest approached, growers would clearly be unable to attend a meeting on identifying insect damage on fruit. Instead of holding meetings, farm advisors and their assistants showed individual growers insect damage on fruit during harvest. This individual attention ensured that growers knew how to identify insect damage they had in their orchard.

Post-Season Meetings

The following meetings were held where project results were presented:

Alternatives to Dormant Insecticide: Using Bt, Yuba City, 11/25/97
Reconsidering the Practice of Dormant Spraying, Modesto, 12/11/97
3rd Annual Stanislaus/Merced Cling Peach Day, Turlock, 1/14/98
Tri-County Cling Peach Meeting, Yuba City, 1/22/98

Acknowledgments: We appreciate the work done by our field assistants on this project - Cressida Silvers, Lana Osgood, Nadeem Shawareb, Chris Christofferson, and Joel Mullinax. We also appreciate the in-kind contribution of Bt ($10,000) from Abbott Laboratories.

ATTACHMENTS

Tables: Butte County Shoot Strike and Trap Catch Summary

Butte County Harvest Summary
Butte County Cost of Program
Sutter and Yuba Counties Shoot Strike and Trap Catch Summary
Sutter and Yuba Counties Harvest Summary
Sutter and Yuba Counties Cost of Program
Stanislaus County Data Summary
Merced and Kings Counties Trap Catch Summary
Merced and Kings Counties Shoot Strike Summary
Merced and Kings Counties Preharvest Summary
Merced and Kings Counties Harvest Summary
Merced County Harvest Graph
Kings County Harvest Graph
Ag Alert Article
California-Arizona Farm Press Article

Mating disruption in Cling Peaches-1997-Shoot Strike and Trap Catch Summary-Butte County

Inspections at 1st Biofix

Date	Grower	Variety	# Trees	Strikes/Tree	OFM Larvae	PTB Larvae	All Pher.	Pher.+ Spray	Trap Catches to Date OFM	PTB	SJS
9-Apr	C.	Loadel	5	0	0	0	X		0	0	0
9-Apr	C.	Ross/Carson/Davis	5	0	0	0		X	0	0	0
9-Apr	G.	Loadel	5	0	0	0		X	0	0	0
9-Apr	G.	Ross	5	0	0	0		X	2	0	0
9-Apr	J.	Davis/Sullivan	5	0	0	0		X	5	0	0
9-Apr	J.	Ross	5	0	0	0		X	3	0	0
9-Apr	A.	Evert/Monaco/Stan.	5	0	0	0		X	2	0	0
9-Apr	A.	19440/Andross	5	0	0	0		X	1	0	0
9-Apr	A.	Stan./Ross/Starn	5	0	0	0		X	0	0	0
9-Apr	O.	19440	5	0	0	0		X	0	0	0
9-Apr	O.	Andross	5	0	0	0		X	0	0	0

Date	Grower	Variety	# Trees	Strikes/Tree	OFM Larvae	PTB Larvae	All Pher.	Pher.+ Spray	Trap Catches to Date OFM	PTB	SJS
20-May	C.	Loadel	5	0.8	0	1	X		1	3	6
20-May	C.	Ross/Carson/Davis	5	3.4	0	1		X	0	1	4
20-May	G.	Loadel	5	1.4	0	2		X	0	51	0
20-May	G.	Ross	5	0.2	0	0		X	2	101	0
20-May	J.	Davis/Sullivan	5	1.2	0	2		X	5	0	0
20-May	J.	Ross	5	1	0	2		X	6	2	1
20-May	A.	Evert/Monaco/Stan.	5	6	1	11		X	3	30	2
20-May	A.	19440/Andross	5	1	0	1		X	1	54	0
20-May	A.	Stan./Ross/Starn	5	0.2	0	0		X	0	35	0
20-May	O.	19440	5	0	0	0		X	1	10	4
20-May	O.	Andross	5	0	0	0		X	2	2	0

PTB= Peach Twig Borer
OFM= Oriental Fruit Moth
Pher.= Pheromone

Inspections at 2nd Biofix

Date	Grower	Variety	# Trees	Strikes/Tree	OFM Larvae	PTB Larvae	All Pher.	Pher.+ Spray	*Trap Catches to Date*		
									OFM	*PTB*	SJS
12-Jun	C.	Loadel	5	4.2	0	0	X		1	9	7
12-Jun	C.	Ross/Carson/Davis	5	3.6	0	0		X	1	7	4
12-Jun	G.	Loadel	5	0.2	0	0		X	0	71	0
12-Jun	G.	Ross	5	1.6	1	0		X	2	131	0
12-Jun	J.	Davis/Sullivan	5	4.2	0	0		X	5	0	0
12-Jun	J.	Ross	5	7.6	0	0		X	6	2	1
12-Jun	A.	Evert/Monaco/Stan.	5	10.4	3	0		X	4	53	2
12-Jun	A.	19440/Andross	5	4.6	0	0		X	1	78	0
12-Jun	A.	Stan./Ross/Starn	5	0	0	0		X	0	67	0
12-Jun	O.	19440	5	2.6	0	0		X	1	16	5
12-Jun	O.	Andross	5	0.2	0	0		X	2	6	0

Inspections at 3rd Biofix

Date	Grower	Variety	# Trees	Strikes/Tree	OFM Larvae	PTB Larvae	All Pher.	Pher.+ Spray	*Trap Catches to Date*		
									OFM	*PTB*	SJS
3-Jul	C.	Loadel	5	3.8	0	0	X		1	51	7
3-Jul	C.	Ross/Carson/Davis	5	16.6	0	2		X	2	1	4
3-Jul	G.	Loadel	5	0.4	0	0		X	0	99	0
3-Jul	G.	Ross	5	1.4	0	0		X	2	156	0
3-Jul	J.	Davis/Sullivan	5	20	7	0		X	5	0	0
3-Jul	J.	Ross	5	11.6	1	0		X	6	3	1
3-Jul	A.	Evert/Monaco/Stan.	5	22.4	0	1		X	4	70	2
3-Jul	A.	19440/Andross	5	10.6	0	0		X	1	179	0
3-Jul	A.	Stan./Ross/Starn	5	0.2	0	0		X	0	119	0
3-Jul	O.	19440	5	15	0	1		X	2	19	5
3-Jul	O.	Andross	5	4.2	0	1		X	3	12	0

PTB= Peach Twig Borer

OFM= Oriental Fruit Moth

Pher.= Pheromone

Mating Disruption in Cling Peaches-1997
Harvest Summary-Butte County

Harvest Date	Grower	Variety	% Worm	% OFM	% PTB	L.R.	T. Bugs	Grade (%Insect)	Phr.	Phr.+Spray
8-Jul	O.	19440	0	0	0	0	0			X
9-Jul	G.	Loadel	0.2	0	0	0.4	0	0.0447		X
9-Jul	C.	Loadel	1.2	0	0.2	0.4	0	0.057	X	
10-Jul	A.	19440	0.6	0	0	0.4	0.4	0.4522		X
16-Jul	A.	Stanislaus	0.2	0.2	0	0.2	0.2	0.1773		X
15-Jul	C.	Carson	3.8	0	0	0	0	0.5612		X
18-Jul	A.	Stanislaus	0.2	0	0	0.6	0	0.3168		X
23-Jul	O.	Andross	0	0	0	0.4	0			X
30-Jul	C.	Dr. Davis	missed harvest					0.4388		X
30-Jul	A.	Andross	0.6	0	0	0.4	0	0.4115		X
31-Jul	C.	Ross	0.8	0	0	0.4	0	0.6219		X
4-Aug	J.	Ross	0.6	0	0	0.2	0	0.2258		X
4-Aug	G.	Ross	0	0	0	0.4	0	0.0633		X
4-Aug	A.	Ross	0	0	0	0	0	0.1242		X
5-Aug	J.	Dr. Davis	0.4	0	0	0.2	0	0.3854		X
14-Aug	A.	Monaco	0.6	0	0	0.2	0	0.3358		X
19-Aug	A.	Evert	0.4	0	0	0.6	0	0.0215		X
26-Aug	J.	Sullivan	0.2	0	0	0.6	0	0.4578		X
26-Aug	A.	Stam	0	0	0	0.4	0	0.1891		X

OFM=Oriental fruit Moth Larvae
PTB=Peach Twig Borer Larvae
Worm=OFM or PTB total worm damage
Std=Standard
Phr.=Pheromone

1997 Mating Disruption in Cling Peaches-Butte County

		PHEROMONE (Cost/A and Brand) & APPLICATION COST						Spray Cost/Materials Used (Includes equipment cost)		Total	# of	# of
		1st Hang		2nd Hang		1st Hang						
Name	Varieties	OFM Cost	Cost/Method	OFM Cost	Cost/Method	PTB Cost	Cost/Method	1st Spray	2nd Spray	Cost	sprays	hangs
C.	Loadel	51.08 (Isomate)	32.00 (ladder)	51.08 (Iso.)	32.00(ladder)	61.55(Her.)	7.00 (poles)	none	none	234.71	0	3
C.	Davis/Ross	51.08 (Isomate)	32.00 (ladder)	none	none	none	none	none	none	83.08	0	1
C.	Carson	51.08 (Isomate)	32.00 (ladder)	none	none	none	none	31.73(Ambush)	none	114.81	1	1
G.	Loadel	47.30 (Consep)	22.49 (poles)	none	none	none	none	26.78 (Ambush)	none	96.57	1	1
G.	Ross	47.30 (Consep)	22.49 (poles)	none	none	none	none	61.18(Amb+Ven)	none	130.97	1	1
J.	Davis/Ross	34.68(Her.94/A)	7.98(tract)	none	none	61.55(Her.)	6.23 (tractor)	28.72(PennCap)	none	139.16	1	2
J.	Sullivan	34.68(Her.94/A)	7.98(tract)	39.85 (Her.)	7.98(tractor)	61.55(Her.)	6.23 (tractor)	28.72(PennCap)	none	186.99	1	3
A.	Evert	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Monaco	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Stanislaus	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	19440	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Andross	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Stanislaus	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Ross	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
A.	Starn	48.02 (Consep)	7.80 (poles)	none	none	none	none	61.18(Amb+Ven)	26.78(Amb)	143.78	2	1
O.	19440/Andr.	47.30 (Consep)	?	none	none	none	none	?	?	?	1	1

ALL PRICES FOR PHEROMONES AND SPRAY MATERIALS INCLUDE SALES TAX

Amb= Ambush
Ven= Vendex
Her= Hercon
Iso= Isomate
spr.= Spray
Pher.= Pheromones
# of Hangs= # of Pheromone(OFM or PTB) Applications

1997 Pheromone Cost-Butte County

Name	1st Hang OFM Cost	2nd Hang OFM Cost	1st Hang PTB COST
C.	51.08 (Isomate)	51.08 (Isomate)	61.55 (Hercon)
A.	48.02 (Consep)	none	none
G.	47.30 (Consep)	none	none
J.	34.68(Herc94/A)	39.85(Herc.108/A)	61.55 (Hercon)

Name	Cost of One Insecticide Spray
C.	31.73
J.	28.72
G.	26.78

Name	Cost of One Insectice Spray + Miticide
G.	61.18
A.	61.18

Note:

All Costs Shown are on a per acre basis.

Pheromone and Spray Costs shown include Sales Tax.

Spray Costs include cost of application equiptment and operator.

1997 PHEROMONE APPLICATION COSTS-Butte County

Name	OFM 1st Hang Application Cost	OFM 2nd Hang Application Cost	PTB 1st Hang Application Cost
C.	32.00 ladder (Isomate)	32.00 ladder (Isomate)	7.00 poles (Hercon)
G.	22.49 poles (Consep)	none	none
J.	7.98 tractor(Herc94/A)	7.98 Tractor (Herc.108/A)	6.23 Tractor(Hercon)
A.	7.80 poles (Consep)	none	none

Mating Disruption in Cling Peaches - 1997 - Shoot Strike and Trap Catch Summary - Sutter/Yuba Counties										
Inspections at 1st Biofix							Trap Catches to Date			BT or Dormant
Date	Grower	Variety	#Trees(5);	OFM Larvae	PTB Larvae	All Pher.	Pher. + Spray	OFM	PTB	insecticide + BT
		Pheromone	Ave.Strikes/tree							
23-Apr	St.	Andross	1	0	0	X		0	0	BT
14-Apr	St.	Bowen	0	0	0	X		0	0	BT
14-Apr	St.	Loadel	0	0	0	X		0	0	BT
11-Apr	H.	Carson	0	0	0		X	0	0	Diaz/no BT
11-Apr	H.	Monaco	0	0	0		X	0	0	Diaz + BT
11-Apr	S.	Stanislaus	0	0	0	X		0	0	BT
19-Apr	S.	Monaco	0	0	0	X		2	0	BT
19-Apr	S.	Carolyn	0	0	0	X		0	0	BT
11-Apr	G.	Sullivan	0.2	0	0		X	1	0	Asana + BT
11-Apr	T.	Halford	0.6	0	0		X	2	0	BT
23-Apr	JR.	Carson	0	0	0	X		0	0	BT
11-Apr	JR.	Andross	0	0	0	X		0	0	BT
"	JR.	Corona	0	0	0	X		0	0	BT
"	JR.	Starn (e)	0	0	0	X		0	0	BT
"	JR.	Sullivan	0.2	0	0	X		1	0	BT
"	JR.	Ross	0.2	0	0	X		0	0	BT
"	JR.	Starn (w)	0	0	0	X		1	0	BT
"	D.	Starn	0	0	0		X	1	0	BT
"	D.	Sullivan	0	0	0		X	2	0	BT
"		Standard								
"	H.	Loadel	0.2	0	0			0	0	
"	H.	Starn	0	0	0			0	0	
"	S.	Andross	0	0	0			0	0	
"	D.	Loadel	0	0	0			1	0	
"	D.	Starn	0	0	0			2	0	

Mating Disruption in Cling Peaches - 1997 - Shoot Strike and Trap Catch Summary - Sutter/Yuba Counties											
Inspections at 2nd Biofix								Trap	Catches to Date		BT or Dormant
Date	Grower	P/Std	Variety	#Trees(5)	OFM Larvae	PTB Larvae	All Pher.	Pher.+ Spray	OFM	PTB	insecticide + BT
				Ave.Strkes/Tree							
10-Jun	St.	P	Andross	4.4	0	0	X		1	2	
"	St.	P	Bowen	1.4	0	0	X		0	1	
"	St.	P	Loadel	0.4	0	0	X		1	0	
"	H.	P	Carson	0.8	0	0		X	1	7	Diaz/no BT
25-Jun	H.	P	Monaco	0	0	0		X	0	2	Diaz + BT
6/10	S.	P	Stanilaus	1.6	0	0	X		1	5	
"	S.	P	Monaco	0.2	0	0	X		3	1	
"	S.	P	Carolyn	0.4	0	0	X		1	1	
"	G.	P	Sullivan	0.4	0	0		X	0	0	
"	T.	P	Halford	0	0	0		X	0	4	
"	JR.	P	Carson	0.2	0	0	X		0	1	
"	JR.	P	Andross	0	0	0	X		0	0	
"	JR.	P	Corona	0	0	0	X		0	1	
"	JR.	P	Starn(E)	0.2	0	0	X		0	0	
"	JR.	P	Sullivan	0	0	0	X		0	0	
"	JR.	P	Ross	0	0	0	X		0	0	
"	JR.	P	Starn(W)	0.4	0	0	X		0	0	
"	D.	P	Starn	0.4	0	0		X	0	0	BT
"	D.	P	Sullivan	0.6	0	0		X	0	0	BT
"	H.	STD	Loadel	1.6	0	0			0	105	
"	H.	STD	Starn	0.8	0	0			0	52	
"	S.	STD	Andross	1.2	0	0			2	50	
"	D.	STD	Loadel	1.4	0	0			4	0	
"	D.	STD	Starn	3.6	0	0			19	6	

Mating Disruption in Cling Peaches - 1997 - Shoot Strike and Trap Catch Summary - Sutter/Yuba Counties											
				Trap Catches to Date				Total Trap Catches			
				June 4		July 17		Aug. 13			
Grower	Variety	All Pher.	Pher.+ Spray	OFM	PTB	OFM	PTB	OFM	PTB		
St.	Andross	X		0	2	0	0	2	2		
St.	Bowen	X		0	0	0	0	1	1		
St.	Loadel	X		0	0	0	0	1	0		
H.	Carson		X	0	2	0	0	1	18		
H.	Monaco		X	0	1	0	9	0	3		
S.	Stanislaus	X		0	1	0	1	1	7		
S.	Monaco	X		0	0	0	0	5	1		
S.	Carolyn	X		0	1	0	0	1	2		
G.	Sullivan		X	0	3	0	0	1	3		
T.	Halford		X	0	0	0	2	2	7		
JR.	Carson	X		0	0	0	0	0	1		
JR.	Andross	X		0	0	0	0	0	0		
JR.	Corona	X		0	0	0	1	0	2		
JR.	Starn(E)	X		0	0	0	0	0	0		
JR.	Sullivan	X		0	0	0	0	1	0		
JR.	Ross	X		0	0	0	0	0	1		
JR.	Starn(W)	X		0	0	0	0	1	0		
D.	Starn		X	0	0	0	0	1	1		
D.	Sullivan		X	0	0	0	0	2	0		
H.	Loadel			6	234	26/2	115	32	454		
H.	Starn			2	139	30	64	48	259		
S.	Andross			3	109	35	82	40	241		
D.	Loadel			5	3	5	0	15	3		
D.	Starn			17	25	24	9	3	40		

Mating Disruption in Cling Peaches - 1997
Harvest Summary - Sutter/Yuba

Date	Grower	Variety	WORM	OFM	PTB	Leafroller	True Bugs	Rust	CM	Grade* Sheet	All Phr	Phr & Spray	STD Spray
Sutter/Yuba													
Jul. 7	S.	Stanislaus(phr)	0.2	0	0	3.2	0			0	X		
Jul. 7	Dh.	Loadel (std)	0	0	0	0.8	0						X
Jul. 10	St.	Loadel (phr)	0.2	0	0	0.8	0			0	X		
Jul. 10	H.	Carson (phr)	0.6	0	0.2	1.4	0			0.323		X	
Jul. 10	H.	Loadel (std)	0.4	0	0	1.6	0			0.041			X
Jul. 14	JR	Carson (phr)	0.8	0.2	0	4.8	0			0	X		
Jul. 21	Dh.	Andross (std)	0.4	0	0	3.8	0			0			X
Jul. 23	JR	Bowen (phr)	4.6	0	0	3.4	0			0	X		
Jul. 23	S.	Andross (std)	2.4	0	0	1	0	(lots)		0			X
Jul. 24	St.	Bowen (phr)	1.6	0.2	0.2	2.2	0.2			0	X		
Jul. 25	JR	Andross (phr)	4.4	0.4	0.2	8.2	0			0	X		
Jul. 26	St.	Andross (phr)	0.8	0	0	3.4	0	0.2		0	X		
Jul. 28	Dh.	Klampt (phr)	0.2	0	0	4.6	0.4	1.4				X	
Jul. 30	Dh.	Ross (std)	1	0	0	2	0	0.8					X
Aug. 1	JR	Ross (phr)	1.4	0	0	8.8	1.4	0.4		0	X		
	S.	Carolyn (phr)	missed	harvest						0	X		
Aug. 5	S.	Monaco (phr)	0.2	0	0	9.6	0.8	1		0	X		
Aug. 11	H.	Monaco (phr)	0	0	0	2	0.2			0.239		X	
Aug. 14	T.	Halford (phr)	0.2	0	0	1.6	0.6			0		X	
Aug. 18	Dh.	Starn (pher)	0.4	0.2	0	6.2	0.8	0.6		0.242		X	
Aug. 18	Dh.	Starn (std)	0	0	0	6.6	1.4	0.4					X
Aug. 22	H.	Starn (std)	0	0	0	3.2	0.2			0			X
Aug. 22	JR	Starn(phr-east)	0.2	0	0	2.8	0			0	X		
Aug. 24	Dh.	Sullivan (phr)	missed	harvest						0.242		X	
Aug. 25	G.	Sullivan (phr)	0	0	0	3.4	0.4	0.4		0.041		X**	
Aug. 25	JR	Corona (phr)	0.4	0.2	0	3.2	0.2	0		0	X		
Aug. 26	JR	Starn(phr-west)	0	0	0	1.8	0	0		0	X		
Aug. 27	JR	Sullivan (phr)	0	0	0	1.4	0	0		0	X		

OFM=oriental fruit moth larva
PTB=peach twig borer larva
CM=codling moth
WORM=OFM or PTB-total worm damage
(std)=Standard
(phr)=Pheromone
* = % insect damage
**=OFM pheromone only

Complete Program
Sutter and Yuba Counties

	Per acre cost of O.F.M. Application				Per acre cost of P.T.B. Application		O.F.M. & P.T.B TOTALS		
	1st or Dual product cost	Hang Labor cost	Dual product cost	Hang(2nd) Labor cost	1st Product Cost	Labor cost	labor cost/acre	pheromone cost/acre	GRAND TOTAL cost/acre
S	44.07 Consep	4.70 by hand	99.00 Consep	4.70 by hand	56.05 Consep	4.70 by hand	14.10	199.12	213.22
ST	89.96* Consep	6.70 poles	98.18 Consep	6.70 poles	~ ~	~ ~	13.40	188.14*	201.54*
JR	46.13 Consep	7.68 poles	95.48 Consep	7.68 poles	53.70	7.68	23.04	195.31	218.35
AVERAGE:	45.10	6.36	97.55	6.36	54.88	6.19	17.17	197.22	215.79

* not included in average - grower used leftover pheromone along with purchased amount for 1st application.

Partial Program
Sutter and Yuba Counties

	Per acre cost of O.F.M. Application		Per Acre cost of P.T.B. application		# of applications	Labor equipment cost/A	spray product, rate, cost/A	miticide product, cost/A	Total Labor Costs	Total Pheromone Costs	Total Spray Costs	Grand Total Costs
	1st	Hang	1st Hang									
	Product Cost	Labor Cost	Product Cost	Labor Cost								
D	40.39	5.25	59.31	6.00	1.00	7.00	Ambush	Vendex	18.25	99.70	47.20	165.15
20A	Isomate	Trailer	Hercon	Trailer			16 oz	.8 lbs				
							19.68	27.52				
G	46.12	7.00*	~	~	1.00	7.00	Ambush	Vendex	14.00*	46.12*	54.00*	114.12*
7A	Consep	by hand					16 oz	1 lb/A				
							19.68	34.32				
H	40.00	6.00	42.50	6.00	2(1 late CVS)	14.00	Ambush	Vendex	26.00	82.50	73.68	182.18
22.5A	isomate	wagon	checkmate	wagon			16 oz/A	1 lb/A				
							39.36	34.32				
T	45.00	7.50	45.58	7.50	1.00	7.00	Pounce		22.00	90.58	27.44	140.02
4.4A	Consep	hand/pole	Consep	hand/pole			14 oz					
							27.44					
						AVE. COST:			22.08	90.92	49.44	162.45
AVE.	42.88	6.25	49.13	6.50		AVE. COST (pher.+1spray pgm.):			20.13	95.92	42.88	152.59
						COST (pher.+2spray pgm.):			26.00	82.50	73.68	182.18

* not included in average because of only one pheromone application; however, included in pher.+1spray average.

Standard Spray
Sutter and Yuba Counties

Grower	# of Application	Labor Equipment cost/A (7.00/A)	Material Rate Costs Per Acre (sales tax included)		Labor + Chemical cost of spray program per acre
			1st spray	2nd spray	
DH					
Loadel	2 + 1 mite	14.00	Penncap-m	Penncap-m	93.48
Starn			6 pints/A	6 pints/A	
			25.98	25.98	
			"	Vendex	
				.8 lbs	
				27.52	
S					
Andross	1*	7.00	Asana		15.40
	(no mite)		6 oz/A		
			8.40		
H					
Starn	2 + 1 mite	14.00	Ambush	Ambush	87.40
Loadel			16 oz/A	16 oz/A	
			19.54	19.54	
			Vendex		
			1 lb/A		
			34.32		
			AVERAGE	AMOUNT:	65.43

*Andross Block surrounded by orchards using mating disruption so had lower moth populations.

Bt Applications as an Alternative to Dormant Insecticides in Commercial Peach Production Systems

Roger Duncan, Farm Advisor, UCCE Stanislaus County
Grower Cooperators: Tim Jarret, Tom Parks

Objective: To observe efficacy of bloom-time applications of *Bacillus thurengiensis* (Bt) in non-dormant treated peach orchards for management of peach twig borer and other pests.

Introduction:
During 1997 a demonstration and education program to manage peach twig borer with *Bacillus thurengiensis* sprays was implemented through funding support from the California Department of Pesticide Regulation. One goal of the project was to familiarize growers, PCAs and farm advisors with the use of Bt as an alternative to traditional dormant sprays. There is evidence that trace amounts of dormant applied insecticides may be entering some watersheds during heavy rain events. Farm advisors and growers from six cling peach producing counties participated in this project, with Bt applied over 246 acres of monitored orchards. Pheromone traps were used to monitor adult males of oriental fruit moth (OFM), peach twig borer (PTB), omnivorous leaf roller (OLR), and San Jose Scale (SJS). During critical periods of insect development, shoots and/or fruit were examined for insect feeding damage.

In Stanislaus County, three orchards were included in this study. Orchard A is a 19-acre field of Carson, Monaco, and Starn cling peaches. This field had not been treated with a dormant insecticide for the past two years but was sprayed with Penncap-M® on May 22 and Ambush® on June 22, 1997. Orchard B is a 26 acre field of Parade, Fairtime, and Carnival free stone peaches which also was not treated with a dormant insecticide but was treated with Penncap-M on May 23. Orchard C is a 38 acre field of Dr. Davis and Ross cling peaches which was treated with a dormant application of Diazinon, but received no in-season insecticide sprays. The Dr. Davis block was treated with OFM and PTB pheromone mating disruption in May. In each of these three orchards, approximately half of the field was treated with two "bloom-time" applications of Bt while the other half received no Bt. On May 28, orchards were monitored for shoot strikes by OFM and PTB. On July 3, fruit were examined for PTB, OFM, and OLR infestation.

Results:
Pheromone trap catches were generally a little lower in Bt treated areas compared to non-Bt treated areas for OLR, OFM, and PTB throughout most of the season. The number of shoot strikes per tree was very high in Orchards A and C but very low in Orchard B. The vast majority of the shoot tip damage appeared to be caused by OFM. There were no differences in the number of shoot strikes per tree between Bt and non-Bt treated areas. Fruit infestation was also high in orchards A and C. Damage appeared to be almost evenly divided between OFM and PTB feeding. Areas that received Bt applications had lower levels of infestation in all orchards.

	Shoot strikes per tree (May 28)	% worm infestation near harvest
Orchard A: Bt	28.8	3.3
Orchard A: no Bt	33.7	6.6
Orchard B: Bt	1.4	
Orchard B: no Bt	0.7	
Orchard C: Bt	14.8	1.7
Orchard C: no Bt	13.4	6.7

Cling Peach Biorational Project 1997
Stanislaus County

Roger Duncan, UC Farm Advisor, Stanislaus County
Joel Mullinax, Student, California State University, Stanislaus
Walt Bentley, IPM Advisor, UC Kearney Ag Center

Grower	Variety	Treatment Dormant	Treatment In-season	Shoot Strikes per tree	Percent Fruit Damage Near Harvest				
					OFM	PTB	OLR	Un known	Total worms
Jarrett	Carson, Starn	None	Penncap-M Ambush	33.7	1.9	1.1	0	3.5	6.6
Jarrett	Carson, Monaco	2 Bt	Penncap-M Ambush	28.8	0.9	1.1	0	1.3	3.3
Jarrett	Parade, Fairtime	None	Penncap-M	0.7					0.4
Jarrett	Parade, Fairtime	2 Bt	Penncap-M	1.4					0.1
Parks	Dr.Davis	Diazinon	Mating disruption	13.4	2.0	2.3	0.1	2.3	6.7
Parks	Ross	Diazinon + 2 Bt	Mating Disruption	14.8	0.6	0.5	0	0.6	1.7

Table 3. 1997 seasonal pheromone trap catches for various insect species in orchards under mating disruption for Oriental fruit moth (OFM) and peach twig borer (PTB) compared to orchards under OFM disruption and organophophate spray program for PTB.

Grower	Males Per Trap Per Season,3/1 - 8/11, (D=Disrupted, S=Sprayed)									
	OFM (S)	OFM (D)	PTB (S)	PTB (D)	OLR (S)	OLR (D)	SJS (S)	SJS (D)	*Encarsia* (S)*	*Encarsia* (D)*
Muradian (Kings)	1.5	1.5	2	2	93	134.5	1741	3517.5	2856	3475.5
Jackson (Kings)	28.5	2.0	455	19	202.5	165.5	637.5	378	55.5	182.5
Chad (Merced)	58	4	418.5	228	47	76	78	23	108.5	225
Kajioka (Merced)	-	2	-	72.5	-	78	-	270.5	-	1564.5
Yagi (Merced)	-	2	-	82	-	42	-	14.5#	-	204.5#

* Key parasioid of San Jose scale attracted to traps.

Traps not placed until the second flight April 10,1997

Table 2. 1997 peach twig insect strike counts in Mating disruption and dormant sprayed orchard comparisons in Kings and Merced Coounties.

Grower	Variety	Date Sampled	Dry	Wilted	Total	# OFM	# PTB	% PTB	Strike/ Tree
Jackson Disruption and Dormant	Andross	5/27/97	11	3	14	1	1	50	0.47
Jackson Dormant	Andross	5/27/97	70	80	150	9	2	19	2.6
Muradian Disruption	Klamt	6/3/97	7	0	7	0	0	0	0.35
Muradian Dormant	Klamt	6/3/97	5	0	5	0	0	0	0.25
Yagi Disruption	Carson	5/21/97	5	8	13	3	5	63	0.43
Kajioka Disruption 1	Ross	5/21/97	5	3	8	0	1	100	0.8
Kajioka Disruption 2	Ross	5/21/97	19	39	58	0	17	100	5.8
Kajioka Disruption 3	Ross	5/21/97	71	23	94	1	8	89	9.4
Chad Disruption	Carson	5/21/97	12	21	33	4	7	64	1.6
Chad Dormant	Carson	5/21/97	16	4	20	5	6	55	1

regular table

regular table

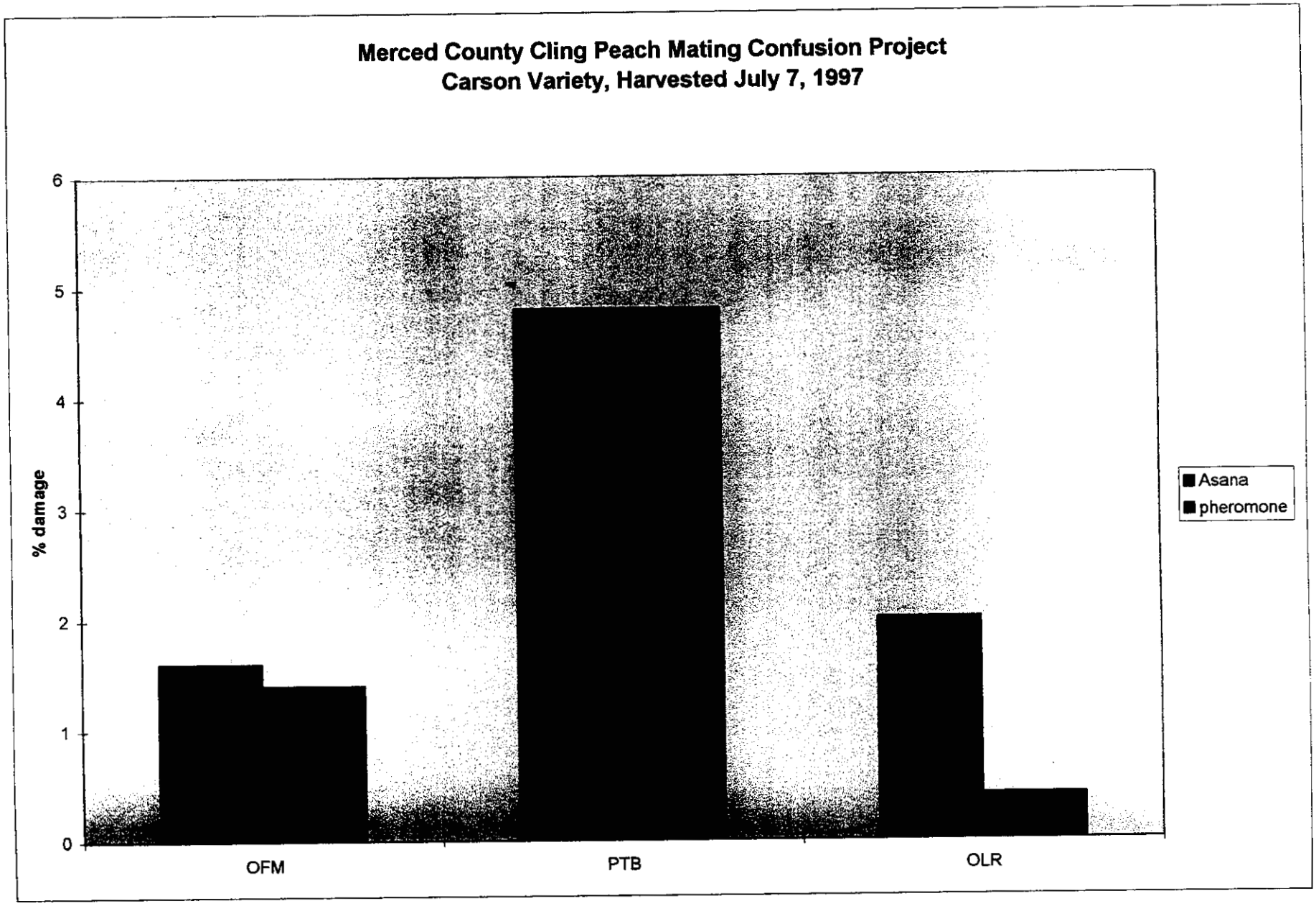
MERCED COUNTY

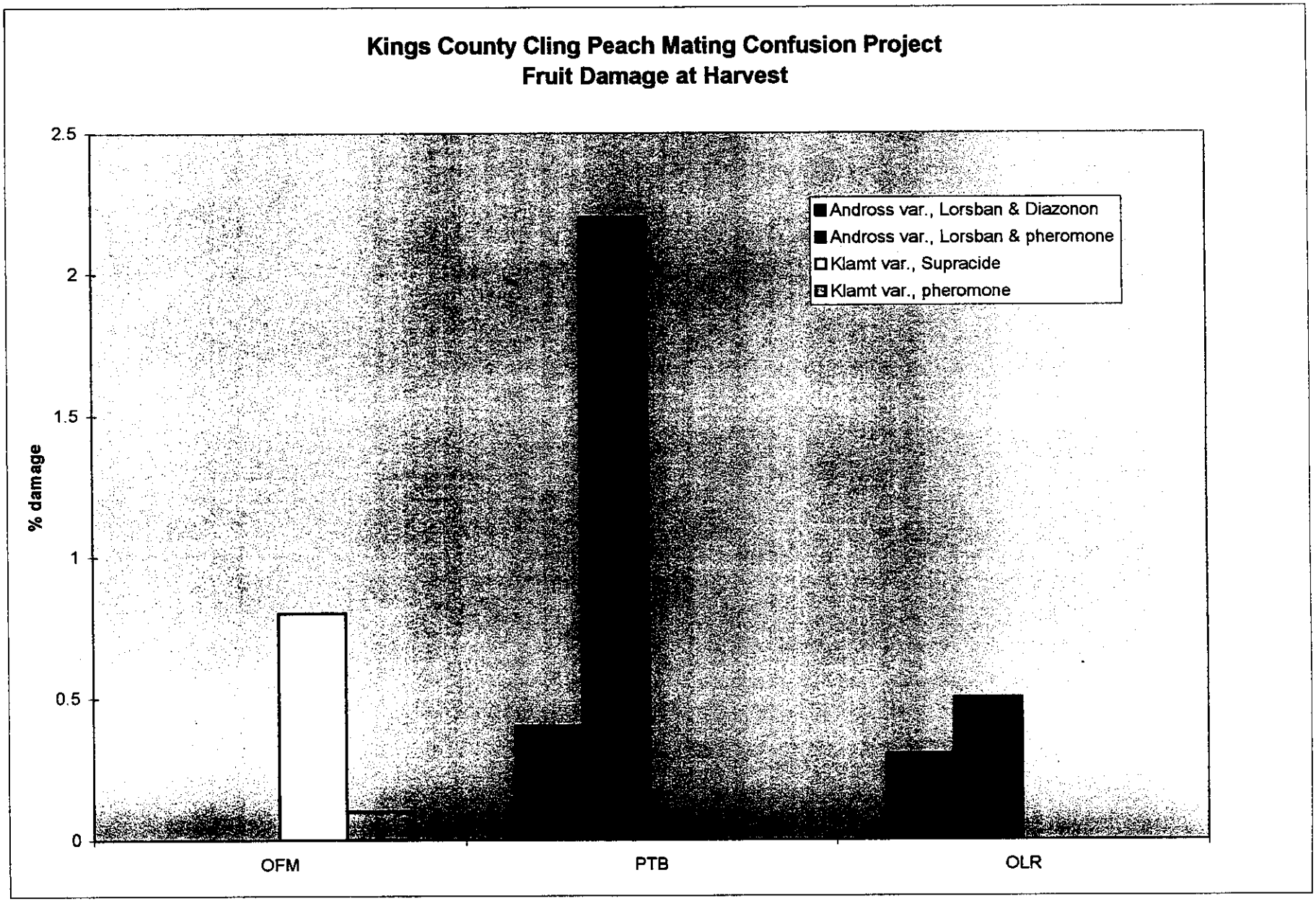
GROWER	TREATMENT/ LOCATION	DATE	# FRUIT SAMPLED			OFM	PTB	OLR	MECH	THRIPS	KATYDID	BROWN ROT	SPLIT PIT	BIRD
Chad	Asana	7/10/97	1000	count		16	48	20	17	9	0	15	3	5
				percent	*Asana*	***1.6***	***4.8***	***2***	***1.7***	***0.9***	***0***	***1.5***	***0.3***	***0.5***
	oil	7/11/97	500	count		7	24	2	6	0	0	5	4	8
				percent	*oil*	***1.4***	***4.8***	***0.4***	***1.2***	***0***	***0***	***1***	***0.8***	***1.6***
Kajioka	all blocks	8/1/97	500	count		2	44	0	5	1	0	3	15	4
				percent		*0.4*	*8.8*	*0*	*1*	*0.2*	*0*	*0.6*	*3*	*0.8*
	back	8/7/97	150	count		3	4	0	0	0	0	1	1	0
				percent		*2*	*2.7*	*0*	*0*	*0*	*0*	*0.7*	*0.7*	*0*
	house	8/7/97	200	count		4	2	0	0	0	0	0	3	0
				percent		*2*	*1*	*0*	*0*	*0*	*0*	*0*	*1.5*	*0*
	shop	8/7/97	150	count		1	2	0	0	0	0	2	0	0
				percent		*0.7*	*1.3*	*0*	*0*	*0*	*0*	*1.3*	*0*	*0*
total count			*1000*			***10***	***52***	***0***	***5***	***1***	***0***	***6***	***19***	***4***
total percent						***1.0***	***5.2***	***0.0***	***0.5***	***0.1***	***0.0***	***0.6***	***1.9***	***0.4***
Yagi	NW	7/10/97	500	count		1	9	5	11	0	1	4	0	4
				percent		*0.2*	*1.8*	*1*	*2.2*	*0*	*0.2*	*0.8*	*0*	*0.8*
	South	7/11/97	500	count		0	11	2	8	1	0	5	1	2
				percent		*0*	*2.2*	*0.4*	*1.6*	*0.2*	*0*	*1*	*0.2*	*0.4*
total count			*1000*			***1***	***20***	***7***	***19***	***1***	***1***	***9***	***1***	***6***
total percent						***0.1***	***2***	***0.7***	***1.9***	***0.1***	***0.1***	***0.9***	***0.1***	***0.6***

KINGS COUNTY

GROWER	TREATMENT/ LOCATION	DATE	# FRUIT SAMPLED			OFM	PTB	OLR	MECH	THRIPS	KATYDID	BROWN ROT	SPLIT PIT	BIRD
Jackson	Diazanon	7/16/97	500	count		0	4	2	1	1	0	0	0	10
				percent		*0*	*0.8*	*0.4*	*0.2*	*0.2*	*0*	*0*	*0*	*2*
		7/24/97	500	count		0	0	1	0	0	0	0	0	0
				percent		*0*	*0*	*0.2*	*0*	*0*	*0*	*0*	*0*	*0*
total count			*1000*			***0***	***4***	***3***	***1***	***1***	***0***	***0***	***0***	***10***
total percent						***0***	***0.4***	***0.3***	***0.1***	***0.1***	***0***	***0***	***0***	***1***
	Lorsban	7/16/97	1000	count		0	22	5	5	2	0	1	8	0
				percent		***0***	***2.2***	***0.5***	***0.5***	***0.2***	***0***	***0.1***	***0.8***	***0***
Muradian	Supracide	7/21/97	1000	count		8	0	0	1	1	0	0	5	1
				percent		***0.8***	***0***	***0***	***0.1***	***0.1***	***0***	***0***	***0.5***	***0.1***
	pheromone	7/21/97	1000	count		1	0	0	2	0	0	1	3	0
				percent		***0.1***	***0***	***0***	***0.2***	***0***	***0***	***0.1***	***0.3***	***0***

grower	block/treatmen	date	# fruit sampled		OFM	OLR	PTB	katydid
Chad	east	6/12/97	100	# damaged fruit	2	3	8	0
				% damage	2	3	8	0
				# live worms	0	2	4	0
	west / Asana	6/12/97	100	# damaged fruit	1	3	5	0
				% damage	1	3	5	0
				# live worms	0	1	3	0
Jackson	Imadan	6/26/97	100	# damaged fruit	0	1	1	0
				% damage	0	1	1	0
				# live worms	0	0	1	0
	pheromone	6/26/97	100	# damaged fruit	0	0	1	1
				% damage	0	0	1	1
				# live worms	0	0	0	0
Kajioka	back	6/12/97	50	# damaged fruit	0	0	0	1
				% damage	0	0	0	2
				# live worms	0	0	0	0
	house	6/12/97	25	# damaged fruit	0	0	1	1
				% damage	0	0	4	4
				# live worms	0	0	0	0
	shop	6/12/97	25	# damaged fruit	0	0	0	0
				% damage	0	0	0	0
				# live worms	0	0	0	0
Muradian	north / pheromone	6/26/97	100	# damaged fruit	0	0	0	0
				% damage	0	0	0	0
				# live worms	0	0	0	0
	south / Supracide	6/26/97	100	# damaged fruit	0	0	0	0
				% damage	0	0	0	0
				# live worms	0	0	0	0
Yagi	Carson	6/12/97	100	# damaged fruit	0	0	1	3
				% damage	0	0	1	3
				# live worms	0	0	1	0


Merced County Cling Peach Mating Confusion Project
Carson Variety, Harvested July 7, 1997
% damage
6
5
4
3
2
1
0
OFM
PTB
OLR
Asana
pheromone


Kings County Cling Peach Mating Confusion Project
Fruit Damage at Harvest
% damage
2.5
2
1.5
1
0.5
0
OFM
PTB
OLR
Andross var., Lorsban & Diazonon
Andross var., Lorsban & pheromone
Klamt var., Supracide
Klamt var., pheromone

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Photos/T.J. Burnham

Live Oak grower Harsev Thiara, left, checks a double pheromone dispenser on peach tree. Farm advisor Janine Hasey, below, has been working with growers on the use of the dispensers.

Pheromone dispensers help growers fight unwanted pests

By T.J. Burnham
Special to Ag Alert

Harsev Thiara wondered for years if the use of pheromones in his cling peaches could help him reduce pesticide applications in a Live Oak orchard on the fringe of urban sprawl.

Two years ago, he jumped into an experiment with Sutter-Yuba counties farm advisor Janine Hasey in which his personal long-term goal was to eliminate the use of pesticides altogether. Now with 60-plus acres involved, Thiara said the program has helped him work successfully in that direction.

"I'm not interested in becoming an organic grower," he said. "I just want to get rid of pesticides so I don't have to deal with all the regulations." Urban encroachment, he added, is another incentive for seeking alternatives.

Today, using pheromones is high on his management priority list, particularly in view of new dispensers which are less inconvenient to use, he explained.

"We had to use a lot of labor originally to tie each dispenser on the upper third of the tree," he said. "Now we're using clip-style dispensers that can be put into the trees on poles. It's quicker and its easier."

He is successfully fighting off both Oriental fruit moth and peach-twig borer with the pheromones, he said. A new dual dispenser for OFM and PTB which is hung at one time is "a big breakthrough," he said. They help him work toward his goal of no pesticides, even if his costs are higher.

"I'm trying hard to get away from organophosphates and pyrethroids," Thiara said. "Last season we used nil of either, and we were successful according to our off-grade sheets. Sure, costs are up, but maybe that's the price of farming today."

As a result of his success, he will continue to use dispensers rather than hard chemicals throughout all of his peach crop, and apply light oil rather than pesticides to fight the overwintering mite eggs and scale. "Finally, we are no longer using any dormant spray pesticides," he said.

All this is part of a statewide program headed up by Hasey to convince growers to try pheromones and oils as options to their normal cling peach pest control programs. Funded by the California Department of Pesticide Regulation, the Biorational Cling Peach Orchard Systems program is making inroads. Farm advisors throughout the peach growing area are involved with the effort, which also encourages use of Bacillus thuringiensis sprays to control pests at bloom.

"Bt has been adopted among almond growers for years, but this is new to cling peach growers to fight overwintering PTB, mites and scale," Hasey said. "Our cooperators had a lot of questions about replacing dormant sprays with bloom Bts because most of them haven't heard about it.

"Looking at shoot strikes for the overwintering gen-

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Peaches

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erations in the BCPOS orchards treated with Bt, we essentially found none," she said. "We are definitely still in transition in cling peaches in terms of getting into these kinds of alternatives," she said, adding "It takes years."

Ironically, mating disruption for OFM was first used in Sutter County years ago, but the practice has diminished there over the years because a lot of the growers resisted the costs, Hasey said. Originally, the big move to pheromones against moths came with a Guthion effectiveness problem, with mating disruption (MD) bringing pest counts in many orchards to zero.

As costs drop on the pheromones, which they appear to be doing today, "I think we'll see a return to the practice by more growers," she said. An economic analysis of the pheromone uses is under way as part of the BCPOS project.

"From our preliminary observations, we seem to see the costs going down a little," she said. "Between 1996 and 1995, the cost went down $25 an acre on the pheromone," she said.

Costs of putting the dispensers in the trees are also dropping dramatically, with one producer now able to do the hanging job at $6 an acre, she said. "That's incredibly cheap."

Growers have balked at using pheromones, which can run about $100-$110 an acre more than the conventional spray, depending on the product used. Harsev reduced his costs of application on older trees by clipping the dispensers directly to tree wires using attachment poles.

"The application is a breeze, a dream, a blessing," he said. "The costs are all in the product itself."

Nevertheless, for a grower who once applied his insecticides with his foliar nutrient sprays, he does face the cost of an added pass through the field for pheromone attachment.

One option producers have under the BCPOS effort is to use a "partial program," which Hasey said is as cheap or cheaper than the traditional spray program. Sutter-Yuba growers in the project used the partial program—one application each of OFM and PTB dispensers in the spring following summer spray—on about 60 acres in 1997, she said.

Participation in the program is impressive. Growers, including Thiara, who used the complete program—four applications of pheromone dispensers—eliminated their need for in-season insecticide and miticides in the process, Hasey said.

The Bt program was tried on another 153 acres to control overwintering PTB, while 25 acres used a dormant spray and Bt. But the program reached much further beyond Hasey's home base. Butte County producers used Bt on 56 acres, dormant spray and Bt on 28 acres, the partial program on 94 acres, and the complete program on three. Due to a large number of shoot strikes, one grower in Butte County reverted to spraying.

In Stanislaus County, 26 acres used partial MD with no summer spray; 17 acres had Bt bloom sprays and no dormant spray. A 38-acre block had one spring OFM MD application and a dormant insecticide. Bt sprays were applied to 15 of these. At another site, 9.5 acres were treated with Bt sprays but no insecticides or mating disruption.

Merced County producers had some problems. They signed up for complete MD on 16 acres, Bt and no dormant spray on 10.5; 11 acres with two OFM and one PTB MD applications. No dormant spray nor bloom Bt sprays were used.

Things are not always successful. Eleven Merced County peach acres had to be sprayed with an insecticide there in late spring due to high PTB counts, and five acres were sprayed in late spring due to secondary pest damage. An insecticide was used in the spring for omnivorous leafroller control.

In Kings County, 12.5 acres were sprayed in the complete program, more than three of which had no dormant spray. No Bt sprays were used in the

BCPOS effort there. The percentage of worms at harvest in all but three MD blocks in Sutter, Yuba and Butte counties fell below 1.6 percent, she said. Normally it was below 0.8 percent. Low worm damage was reported from Kings County, with both MD blocks less than 0.8 percent.

MD blocks in Merced County had 4.8 percent or higher PTB damage. Two of the blocks in the effort were surrounded by untreated almonds, which serve as a source of pests.

Work to develop a pheromone puffer or sprayable products may evolve technology which will help reduce the costs of using pheromones. "If a grower could put this stuff in his spray tank, I think you would see a lot of growers using it if it were effective."

Part of the effort under Hasey was to form project management teams to help cooperators tackle the bold new concept of complete or partial MD and use of Bt. She also organized pest control advisor and grower field and breakfast meetings to discuss the concept and experiences.

One concern which has come up is with insects like oblique banded leafroller.

"The Bt put on by growers at bloom with fungicide was for overwintered PTB, and this also helped get the first generation of leafroller," she said. "Later in the season we began seeing some summer leafroller damage from the second generation. We need to come up with a new spray timing for Bt to control this pest, if damage continues to show up."

An important part of the BCPOS program, she said, is to monitor for pests no longer controlled by broad spectrum sprays which the growers used previously. Based on the data in Northern California, the pheromone-Bt program "looks quite successful," said Hasey.

Thiara said he is pleased with his program not only because it works, but because he "doesn't like handling pesticides" due to the safety problems involved. "I am also very happy to use a practice that does not destroy our beneficials."

But what he likes most, Thiara said, "is that pheromones give us a chance to get rid of the regulation and the policing we have to put up with when we use chemicals.

with Bt option program

Less orchard pollution of water seems likely

By T.J. Burnham

CLING CROP advisors attending the Tri-County Peach meeting in Yuba City included crop advisors, from left, Bob Hanke, Pete Montna and Jim Howard, all consultants with headquarters in the Yuba City area.

IF YOU HAD ASKED California Department of Pesticide Regulation (DPR) spokesman Marshall Lee a few years ago what the No. 1 *agricultural water* pollution source was, he would have pointed to the rice industry.

Now he singles out the orchard industry *and its controversial use of* dormant sprays which are spilling pollutants like diazinon into the winter surface water. "The rice industry has pretty much cleaned up *its act*," he *said*, calling for similar action by cling peach and other orchard crop producers.

Cleaning up the water by the industry seems to be well within the scope of the possible, according to new research into a peach biorational program that offers Bt option along with

TREES AND VINES

its pheromone recommendations.

Using Bt appears to be successful for some who have adopted the dormant spray substitute, and costs are *about the same.*

Results of the 1997 Biorational Program funded in part by the DPR show encouragement for the pest control effectiveness of the *effort if not the* economic effectiveness.

The Sutter-Yuba-Butte section of the statewide pheromone study with farmers use complete or partial mating disruption in their orchards resulted in zero oriental fruit moth (OFM) in nine orchards, only one to two in 17, and three to five in five orchards, reported Sutter-Yuba counties farm advisor Janine Hasey.

Peach twig borer numbers ranged from zero in eight orchards; one to two in nine orchards; three to five in three, and six or more in three orchards, she said during a Tri-County Cling Peach meeting in Yuba City.

"The higher counts for PTB and OFM were both in the partial programs," she *said, which did not use total* dependence on pheromone controls.

Using Bt for overwintering PTB was successful, she said, although questions remain over *how to control San* Jose scale adults without using hard pesticides, although few scale problems were reported in the test blocks during 1997.

Importantly, of the 15 orchards using complete OFM/PTB pheromone programs, these had only 1.9 percent worm damage or less, as did most of those using partial pheromone applications.

Levels in check orchards using standard spray programs were much higher, said Hasey.

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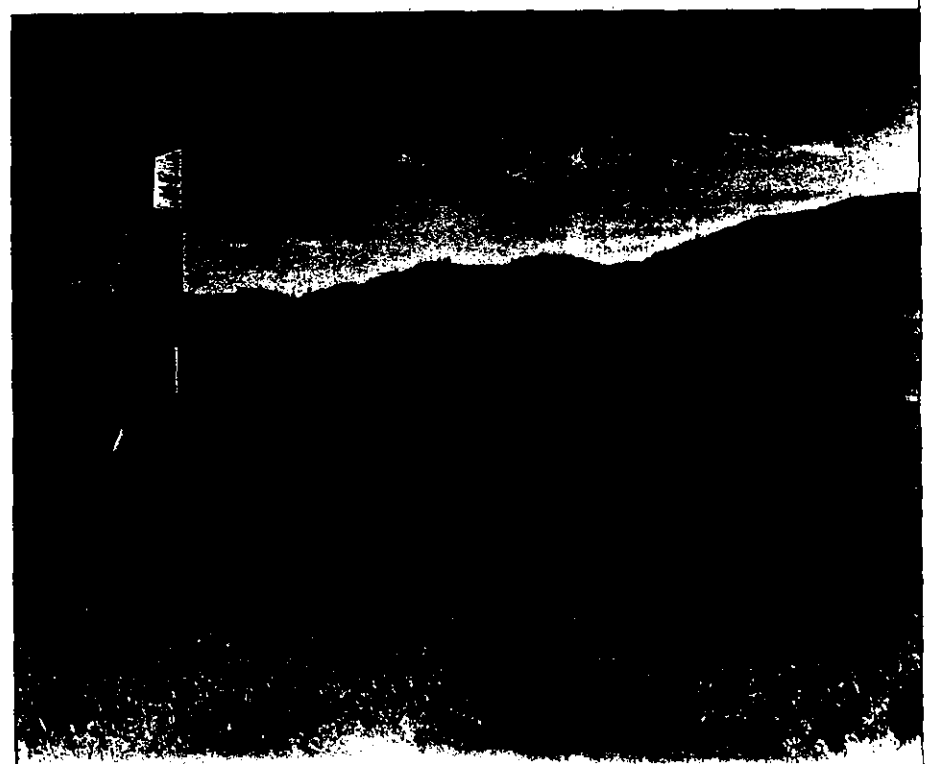

TREES AND VINES

Orchard pheromone costs

(Continued from Page 22)

One problem which remains is the control of second generation oblique banded leafrollers, she said. While the Bt appears to control the first generation, which causes heavier scars to fruit, the less damaging second generation appears to be uncontrolled. Damage up to 9.6 percent was reported on some blocks in both complete and partial programs, with all varieties exhibiting some leafroller harm. Sprayed orchards also revealed similar defects.

Costs using OFM 90-day pheromone were put at an average of $43.86 an acre for the material, with a range of $39.85 to $51.08 an acre, said Hasey. A 90-day PTB pheromone retails for an average of $55.19 an acre, ranging from $42.50 to $61.55, she said.

Using the new dual dispensers which emit both OFM and PTB pheromones from separate chambers on a single unit attached to the tree was put at $97.55, or about $48.78 for each pheromone. Application costs would be reduced using this technology since crews would not be needed to place PTB and OFM dispensers separately.

Costs of application vary widely since methods of placing the units in the trees differ among growers, with some still opting to use the most expensive technique of moving ladders from tree to tree. Others using tractor-pulled platforms or hand poles now provided by pheromone companies were able to reduce their costs, she said.

"Growers using poles have brought their costs of application down considerably," she said, with one operator reducing the expense of placing dispensers to $6.37 an acre, while others may pay closer to $22.49 an acre. Ladder operations, she said, cost $32 an acre.

The overall program for pheromones and application appears to be going down, she said, with 1995 expenses at $243 an acre; $223 in 1996, and currently averaging about $215.79.

"But that's still too expensive," said Hasey, who noted producers using the partial program which may include up to two sprays were able to reduce their overall costs to from $143.78 to $153.33 an acre.

Using the standard spray program in operation at most orchards today costs about $93 an acre, she said.

Dormant insecticide alternative costs are more attractive, with two to three pound applications of diazinon at about $25 an acre compared with Bt at two one-pound per acre rates *($10 each) averaging $20*. "That's pretty much a wash," she said of the cost comparisons.

The study will continue, she said, with the focus on producers using the complete program. One such producer, J.R. Thiara, said he is pleased with results in his Yuba City area orchard regardless of the high costs.

Thiara, who farms near schools and residential areas, said he is forced to move away from hard chemicals to avoid constant monitoring by pesticide enforcement agents.

"We are reaching the time when we will lose dormant sprays," he said. "I decided to make my changes now."

While the biorational program "may not be cheaper on the pocketbook," he said, "it certainly is worthwhile in the peace of mind it brings because of possible liability and toxicity problems" use of other products may bring.

Noting that he "set the record for high application costs" when he joined the biorational program two years ago, Thiara said results from the experiments were "pretty much zero worm damage" in orchards where he had always seen some worm problems.

Adding the Bt program to his complete pheromone system last year, Thiara said applying the material with fungicides helps reduce costs. "The Bt control was a total success," he said.

While the pheromone system costs are high, he said getting zero deducts for worm at the grading table helps offset expenses with premium payments (fewer offgrade deducts). "Getting zero at the grading table is pretty unusual for machine harvesting," he said.

He reported about 1 to 2 percent leafroller damage from second generation oblique pests.

"If we can target this one, then we'll have a system which controls three pests and provides us a crop that makes more dollars in premiums," he said.

"That will go a long way toward offsetting these higher costs."